Energy Management
Modular Energy meter
Type EM2-96

- **Class 1 (active energy)**
- **Class 2 (reactive energy)**
- **Modular energy meter**
- **Front size: 96x96 mm**
- **6-dgt µP-based indicator**
- **Manual scrolling of partial and total energies: kWh, kVArh.**
- **TRMS measurement of distorted waves (voltage/current)**
- **All configuration functions selectable by built-in key-pad**
- **Password protection of programming parameters**
- **Front reset of partial energies**
- **Degree of protection (front): IP 65**
- **Optional serial RS 422/485 port**
- **MODBUS, JBUS protocol.**

Product Description

µP-based modular energy meter with a built-in configuration key-pad. The energies are both partial and total counted. The housing is easy to mount on a panel and ensures a degree of protection (front) of IP 65.

Ordering Key

EM2-96 AV53D XXX

- **Model**
- **Range code**
- **System**
- **Power supply**
- **1st Output**
- **2nd Output**

Type Selection

Range code

AV5: 250/433 VAC - 5 AAC (max. 300 V (L-N)/ 520 V (L-L) - 6 A)

AV7: 400/690 VAC - 5 AAC (max. 480 V (L-N)/ 830 V (L-L) - 6 A) [1]

System

3: One phase, three-phase system, 3 or 4 wires, balanced load; three phase system, 3 or 4 wires, unbalanced load

Power supply

A: 24 VAC, -15% +10%, 50/60 Hz [1] [2]
B: 48 VAC, -15%+10%, 50/60 Hz [1] [2]
C: 115 VAC, -15% +10%, 50/60 Hz [1] [2]
D: 230 VAC, -15% +10%, 50/60 Hz [2] (standard)
L: 18 to 60VDC/AC [3]
H: 90 to 260VDC/AC [3]

1st Output (contact)

XX: No output (standard)
O1: Single open collector output (30V/100mADC) [1]
O2: Dual open collector output, the second one is the copy of the first one, like "O1" [1]
R1: Single relay output, (AC1-8AAC, 250VAC) [1]
R2: Dual relay output, the second one is the copy of the first one, like "R1" [1]

2nd Output

X: No output (standard)
S: Serial port, RS 485 multidrop bidirectional with control relay [1]

[1] On request
[2] Warning: **This power supply cannot be used if the RS485 module is needed**
[3] Compatible with any kind of output

Input Specifications

Accuracy (48 to 62 Hz) (@ 25°C ±5°C, R.H. ≤ 60%)	±1% RDG (kWh) ±2% RDG (kvarh) (hour time base) PF ≥ 0.7L/C, 0 to 1.2 In, 0.5 to 1.2 Un
Additional errors	
Humidity	<0.3% f.s., 60% to 90% R.H.
Power supply	±0.5% rdg, -15 +10% p.s.
Magnetic field	< 0.1% f.s. @ 400 A/m
Rated input	
Current	2 inputs (one/three-phase balanced load) 6 inputs (one/three-phase unbalanced load)
Voltage	2 inputs (one/three-phase balanced load) 4 inputs (one/three-phase unbalanced load)
Insulation	among the voltage and the current inputs: 2000 Vrms; among the current inputs: 2000 Vrms
Temperature drift	±250 ppm/°C
Display	Backlighted LCD, h: 13mm, 6-dgt
Decimal point position	Automatic selection according to the counted energy. Max resolution: 1 Wh/1 VArh Min. resolution: 1 KWh/1 KVArh
Max. and min. indication	
Active energy	Max. 999999 min. –199999
Reactive energy	Max. 999999 min. 0
Sampling rate	3 times / second

Input Specifications (cont.)

Measurements	
Total energies	kWh, kvarh
Partial energies	kWh, kvarh (the meters are automatically reset when the values reach 14999*CT ratio).
Measurement method	TRMS measurement of a distorted voltage/current wave Coupling type: Direct Crest factor: ≥ 3
Ranges (impedances)	
	250 V/433 V (≥ 400kΩ) 5 AAC (≤ 0.3 VA / ≤ 0.1Ω) 400V/690V (≥ 650kΩ)
Frequency range	48 to 62 Hz
Over-load protection	Un: 250V (AV5), 400V (AV7), In: 5A
Continuous: voltage/current	1.2 Un/In
For 1 s	
Voltage:	2 Un
Current:	20 In

Keyboard	4 keys: "Δ∇": - to enter programming phase and password confirmation; - for value programming and basic measurement scrolling. "E": - for confirmation of new programmed values and going ahead to the next programming step, - total or partial energy scrolling. "R": - for the reset of the partial counted active and/or reactive energy.

Output Specifications

Contact port (on request)	
Number of outputs	1, independent
Type	Driven only by the serial communication
Static type	Open collector (NPN transistor) V_{ON} 1.2 VDC / max. 100mA V_{OFF} 30VDC max.
Relay type	1 x SPDT AC 1 - 8A, 250VAC DC 12 - 5A, 24VDC AC 15 - 2.5A, 250VAC DC 13 - 2.5A, 24VDC 130.000 cycles
Insulation	By means of optocouplers, 4000 Vrms output to measuring input, 4000 Vrms output to supply input.
Serial port (on request)	
Type	RS422/RS485; Multidrop bidirectional (static and dynamic variables)
Connections	4 wires, max. distance 1200 m, termination directly on the module
Addresses	1 to 255, selectable by key-pad

Protocol	MODBUS/JBUS
Data (bidirectional)	
Dynamic (reading only)	System variables: P, Q, PF, V_{L-L}, energies, Single phase variables: P_{L1}, Q_{L1}, PF_{L1}, V_{L1-N}, A_{L1}, P_{L2}, Q_{L2}, PF_{L2}, V_{L2-N}, A_{L2}, P_{L3}, Q_{L3}, PF_{L3}, V_{L3-N}, A_{L3} For the accuracy information refer to WM2-96
Static (writing only)	All programming data, reset of energy: - partial kWh - partial kVArh - total kWh - total kVArh Stored energy (EEPROM) ≤ 999999 kWh ≤ 999999 kVArh
Data format	1-start bit, 8-data bit, no parity/even parity, 1 stop bit
Baud-rate	1200, 2400, 4800 and 9600 selectable bauds
Insulation	By means of optocouplers, 4000 Vrms output to measuring inputs 4000 Vrms output to supply input

Supply Specifications

AC voltage	230 VAC (standard), -15%+10% 50/60 Hz 24 VAC, 48 VAC, 115 VAC (on request), -15%+10% 50/60 Hz 18 to 60 VDC/AC 90 to 260 VDC/AC
Power consumption	≤ 30VA / 12W (90 to 260V) ≤ 20VA / 12W (18 to 60V)

Software Functions

Password	Numeric code of max. 3 digits; 2 protection levels of the programming data
1st level	Password “0”, no protection
2nd level	Password from 1 to 255, all data are protected
Measurement scrolling	total and partial active energy (kWh), total and partial reactive energy (kVArh) Partial energy meters: the counters of kWh and kVArh are automatically reset when the energy reaches the value (14999*CT ratio).
	Example: the CT is a 100A/5A so the ratio is 20, consequently the maximum counted energy is 299980 kWh or kVArh.
Transformer ratio	For CT up to 5000 A
Programmable ratio	0.1 to 999.9
Digital Filter	
Filter operating range	0 to 100% of the input electrical scale
Filtering coefficient	1 to 64
Filter action	Only on the variable being transmitted by the serial communication port

General Specifications

Operating temperature	0° to +50°C (32° to 122°F) (R.H. < 90% non-condensing)
Storage temperature	-10° to +60°C (14° to 140°F) (R.H. < 90% non-condensing)
Insulation reference voltage	300 Vrms to ground
Insulation	4000 Vrms between all inputs/outputs to ground
Dielectric strength	4000 Vrms for 1 minute
Noise rejection	
CMRR	100 dB, 48 to 62 Hz
EMC	EN 50081-2, EN 50082-2
Safety standards	IEC 61010-1, EN 61010-1
Approvals	CE UL, CSA
Connector	Screw-type, max. 2.5 mm^2 wires x 2
Housing	
Dimensions	96 x 96 x 140 mm
Material	ABS, self-extinguishing: UL 94 V-0
Degree of protection	Front: IP65
Weight	Approx. 500 g (packing included)

The available modules

Type	N. of channels	Ordering code	Note
EM2-96 base + AV5.3 input		AC1014	
EM2-96 base + AV7.3 input		AC1015	
24VAC power supply		AP1025	Neither UL nor CSA approved
48VAC power supply		AP1024	Neither UL nor CSA approved
115VAC power supply		AP1023	Neither UL nor CSA approved
230VAC power supply		AP1022	Neither UL nor CSA approved
18-60VAC/DC power supply		AP1021	
90-260VAC/DC power supply		AP1020	
RS485 port	1	AR1034	
Relay output	1	AO1058	
Relay output	2	AO1035	The second output can be used as redoundant output
Open collector output	1	AO1059	
Open collector output	2	AO1036	The second output can be used as redoundant output

The possible module combinations

Slot	B	D
Basic unit	**Out 1**	**Out 2**
RS485 port	●	
Single relay output		●
Single open collector output		●

Slot	B	D
Basic unit	**Out 1**	**Out 2**
RS485 port	●	
Dual relay output		●
Dual open collector output		●

Mode of Operation

Waveform of the signals that can be measured

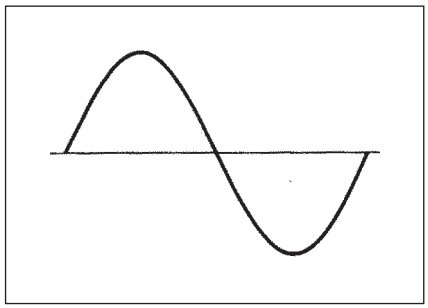


Figure G
Sine wave, undistorted

Fundamental content	100%
Harmonic content	0%
A_{rms} =	1.1107 I $\overline{A}$ |

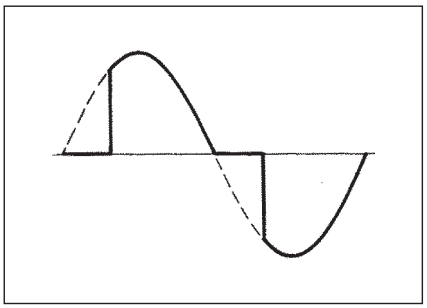


Figure H
Sine wave, indented

Fundamental content	10...100%
Harmonic content	0...90%

Frequency spectrum 3rd to 16th harmonic
Required result: additional error < 1%

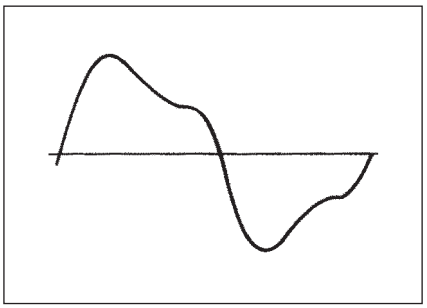


Figure I
Sine wave, distorted

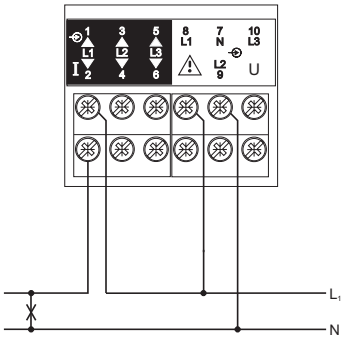
Fundamental content	70...90%
Harmonic content	10...30%

Frequency spectrum 3rd to 15th harmonic
Required result: additional error < 0.5%

Wiring Diagrams

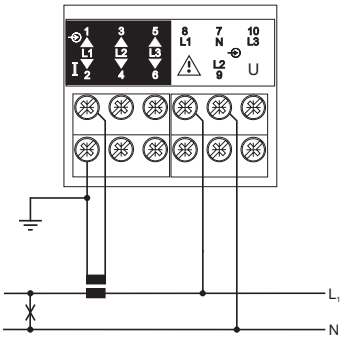
Single phase input connections

Fig. 1



Direct connection

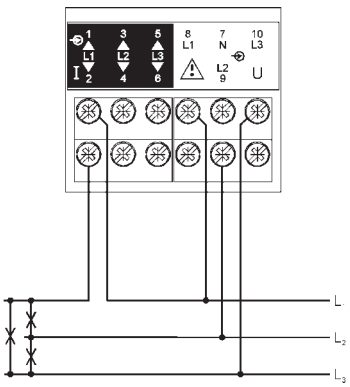
Fig. 2



CT connection

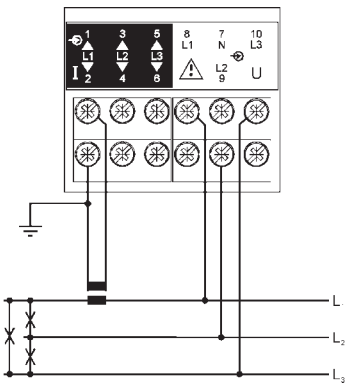
Three phase/3-wire input connections - Balanced loads

Fig. 3



Direct connection (3-wire system)

Fig. 4



CT connection (3-wire system)

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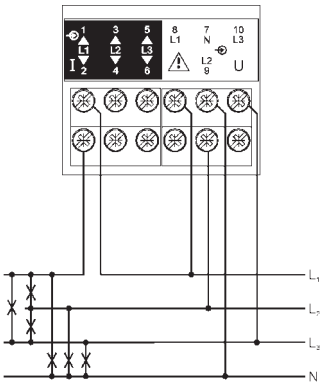
Wiring Diagrams (cont.)

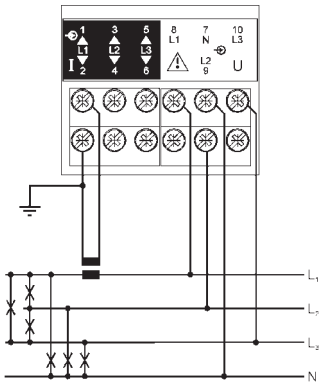
Three phase, 4-wire input connections - Balanced loads

Fig. 5



Direct connection (4-wire system)

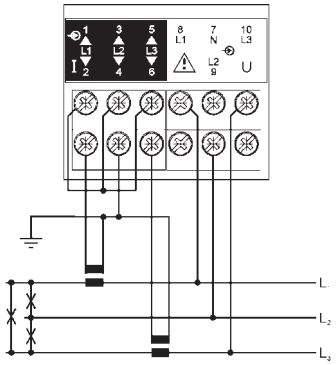
Fig. 6



CT connection (4-wire system)

Three-phase, 3-wire input ARON connections - Unbalanced load

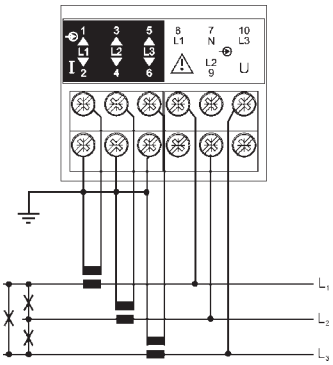
Fig. 7



CT connection (3-wire system)

Three-phase, 3-wire input connections - Unbalanced load

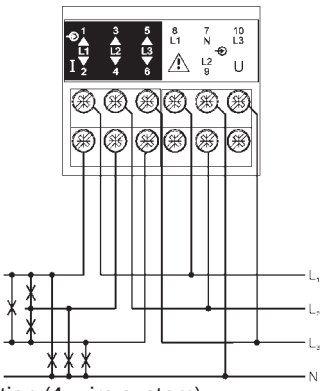
Fig. 8



CT connection (3-wire system)

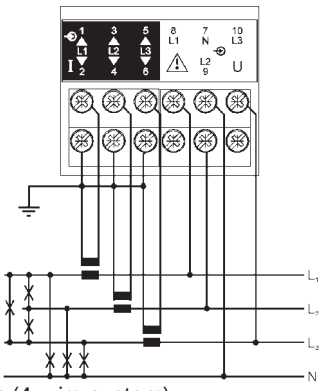
Three phase, 4-wire input connections - Unbalanced load

Fig. 9



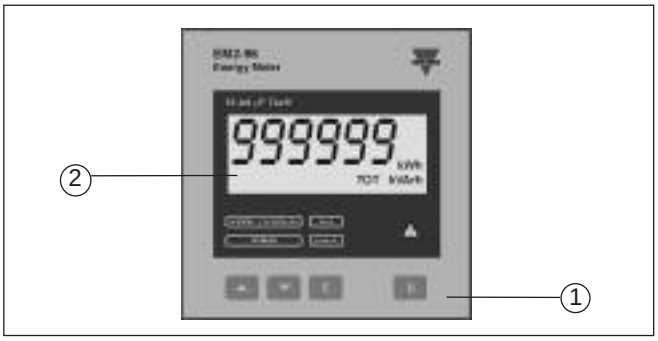
Direct connection (4-wire system)

Fig. 10



CT connection (4-wire system)

Front Panel Description



1. Key-pad
Set-up and programming procedures are easily controlled by the 4 pushbuttons.

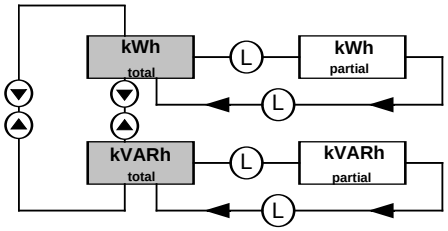
▲ and ▼
- To scroll all the basic measurements (system variables)
- To increase or decrease programming values
- To enter into the programming procedure and select programming functions together with the ”L” key

“E”: To select the partial or total counted energy
“R”: To reset the partial counted energies (kWh, kVArh).

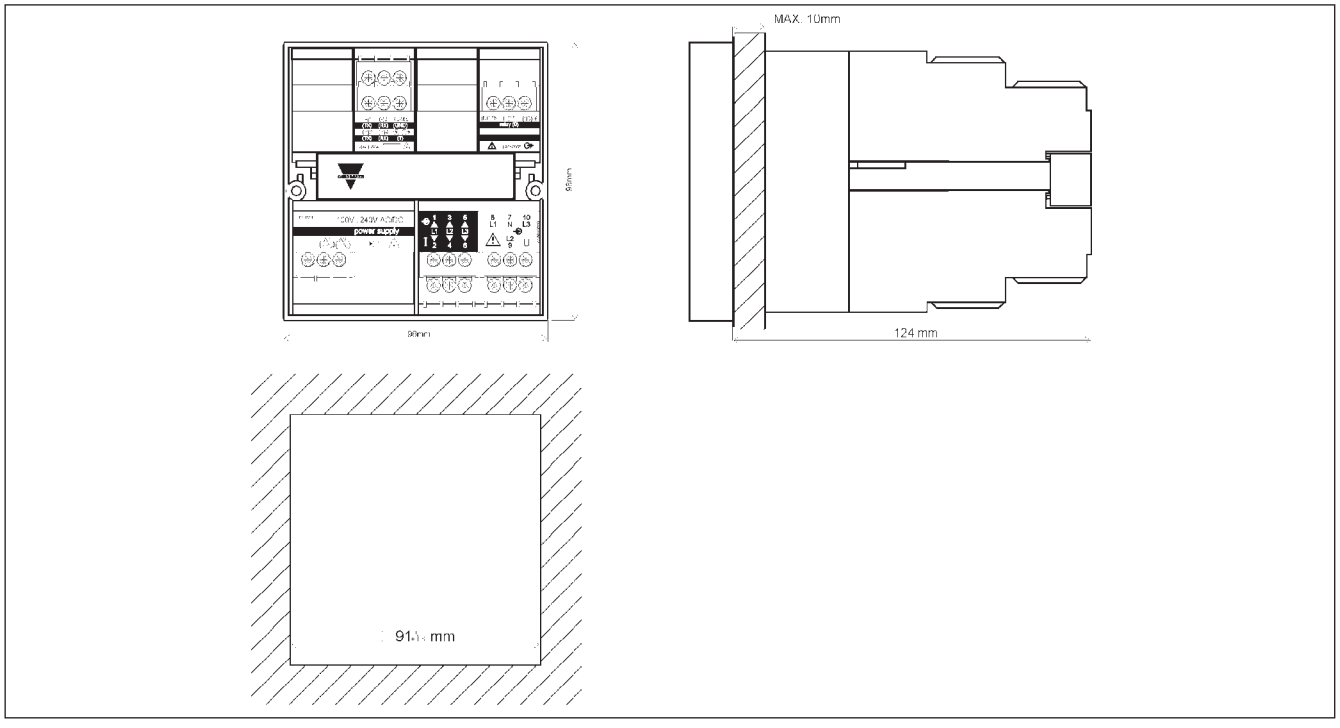
2. Display
- 6-digit (maximum read-out 999999).

Alphanumeric indication by means of LCD display for:
- Displaying the configuration parameters
- All the measured variables.

Sequence of the variables on the display



Dimensions



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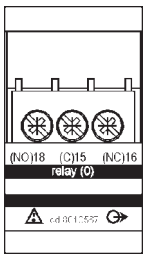
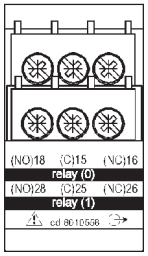
Terminal boards

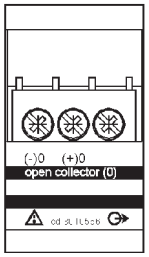
Digital output modules



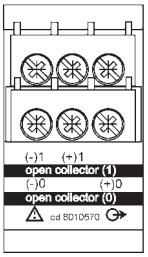
AO1058
Single relay output



AO1035
Dual relay output

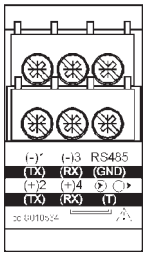


AO1059
Single open collector output



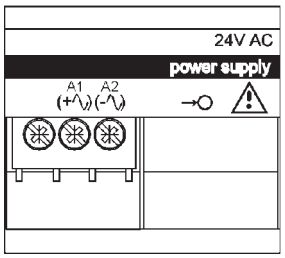
AO1036
Dual open collector output

Other input/output modules

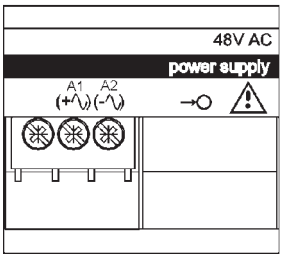


AR1034
RS485 port

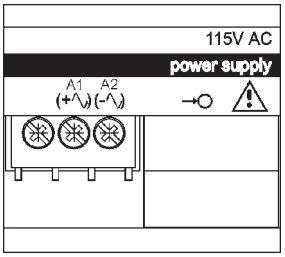
Power supply modules



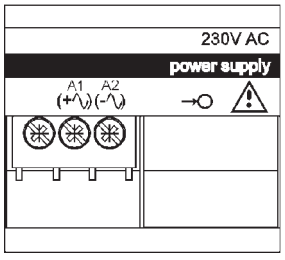
AP1025
24VAC power supply



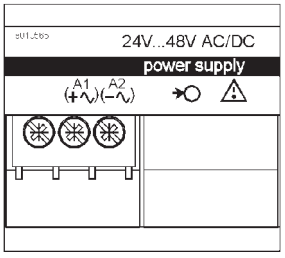
AP1024
48VAC power supply



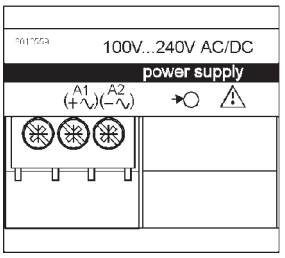
AP1023
115VAC power supply



AP1022
230VAC power supply



AP1021
18-60VAC/DC power supply



AP1020
90-260 VAC/DC power supply